Green Inland Ports

Good Practices

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Electrification of equipment and energy efficient technologies

1.0 Electrification of equipment and energy efficient technologies

1.1 Description

Electrical power is essential in the shift to a more modern, efficient and sustainable shipping industry. More recently, port electrification has involved container terminals, compared to dry and liquid operations, and the naval defence sector, which has been using electrified equipment or shore power for decades (WSP, 2023). The port industry follows the global trend of taking responsibility for the consequences of their activities and aiming to reduce the carbon footprint involved with the cargo handling at ports. When port operations are electrified, this normally leads to reduced port-related emissions, depending on the electricity source used.

Ports are often inside or close to a city, which leads to potential issues of localised emissions, such as noise and odour. This pushes for more ambitious targets in relation to environmental concerns and social responsibility. This shift can be costly, but many terminal operators are willing to bear a certain amount of costs to be achieve zero emissions (WSP, 2023).

This good practice concerns a broad term, which entails:

- The appliances and equipment that use certain technologies which are less energy intensive than conventional machinery (examples would be efficient hulls for ships or handling cranes with energy recovery); and
- The electrification of machinery/equipment (such as cranes, reachstackers, (semi-)trailers, etc.)
- Overlap with the good practice called "*clean air programme*".

1.2 Specific aim of the measure

The use of energy-efficient and/or electrified machinery results in a reduction of required fuel and/or electricity. This results in a reduction of GHG emissions, a reduction of air pollutant emissions and cost savings. The reduction target can differ per port as ports often set a target based on the local situation and potential.

Parties where electrification of equipment has been implemented

- Bayernhafen
- Port of Hamburg

- Port of Venlo
- Port of Amsterdam
- Port of Dörpen
- Port of Andernach
- Port of Giurgiulesti
- Minden Port
- Port of Wittingen
- Port of Venlo
- Barge Terminal Tilburg (BTT)
- Contargo
- KOTUG
- ZULU Associates
- Van Berkel Logistics

Stakeholders

- Port authority: Port authorities are responsible for what happens within the port area. They manage the port infrastructure, which is an important aspect within this good practice.
- Terminal operators: Smaller port machinery, such as reach stackers, terminal tractors, forklifts, container handlers are owned by terminal operators.
- Inhabitants nearby: Air pollution is often a relatively local problem, as the effects are experienced in the vicinity. Electrification of equipment and more efficient technologies will reduce emissions of air pollutants and will decrease possible noise and odour complaints.

Voluntary or mandatory

Electrification of equipment and energy efficient technologies are not mandatory by themselves. The EU's climate plans contain relatively few direct measures for inland shipping. In the Netherlands for example, the sector has signed a Green Deal with the government to achieve a 35-50% reduction in CO_2 emissions by 2035 compared to 2015, with the primary goal of achieving zero-emission transport over water by 2050 (NPRC, n.d.).

Potential impact

It is estimated that the global fleet of Container Handling Equipment (CHE) in ports consists of 100,000 to 120,000 machines, which together are responsible for 10 to 15 million tonnes of carbon

dioxide per year (scope 1 and scope 2 emissions). These emissions are equal to the annual emissions of a country such as Slovenia (APM Terminals, 2023). Based on a case study WSP (2023), a container terminal with 80% of its equipment operating on diesel can reduce over 30% of its GHG emissions if it switches to a full electric operation.

Within the port of Hamburg, HHLA Container Terminal Altenwerder tested battery-powered terminal tractors, which were used to move cargo containers and semi-trailers across short distances in 2021. Based on positive experiences, seven additional tractor units were ordered, and sufficient charging infrastructure is being installed. Over the course of its expected life cycle, the new electrified equipment will save nearly 3,000 tonnes of CO_2 compared to diesel machines (Port of Hamburg, 2022).

The port of Amsterdam uses a technology to partially electrify their diesel-powered cranes. According to the port, full electrification or retrofitting of the cranes would be too costly, so instead they use technology that captures energy during lowering of freight and then redistributes the energy to power the lifting of freight. Using this technology generates more than 25% savings in fuel consumption and carbon tax for the port (EIT InnoEnergy, 2022).

1.3 Possible obstacles when implementing

- Sufficient supply of zero-emission machinery and the specs of the different types of machinery, such as the weight that it can carry. (Schrupp, M. & Moorcroft, R., 2023)
- In many European countries, lack of grid capacity is a substantial problem that halts electrification purposes. Europe's electricity grids are often seen as the main bottleneck to getting more clean energy into the network (Reuters, 2023) (Eclareon et al., 2012).
- Many ports already have existing infrastructure that was designed for diesel-powered operations. Adapting infrastructure to serve an electric operation calls for considerable modifications, which also comes with high investment costs required to realize a robust electrical system (WSP, 2023).
- At the moment, battery-electric ground vehicles are more expensive than diesel vehicles to purchase, and take longer to charge. The high upfront costs are delaying the transition to zero-emission vehicles (Morris, C., 2023). A TCO comparison analysis by APM Terminals & DP World, (2023) suggests that battery electric container handling equipment is between 14% and 34% more expensive in terms of Total Costs of Ownership (TCO) than their diesel counterparts. Hydrogen electric container handling equipment is between 67% and 139% more expensive in terms of TCO than their diesel counterparts.
- Inland ports have indicated to find it, on average, relatively difficult to implement due to the above-mentioned reasons (source: Green Inland Ports survey, 2024).

1.4 Key learnings

- For electrification of container handling equipment and other port equipment, it is important to not only look at the investment costs and total costs of ownership, but it is also important to regard the electricity grid capacity within port areas. If this is not possible, contact with the electricity network operator is necessary on forehand.
- Significant reductions in fuel consumption and GHG/air pollution reduction can be achieved through this good practice. However, the port equipment should be available on a larger scale and the equipment must meet the user requirements in terms of charging capacity and lifting limits.

1.5 Sources

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